

Summary of Significant Accomplishments, Phase 2, "Defining Earth System Enterprise Information Needs & Pilot Programs for Utilization by Local Government in the Eastern U.S." during the reporting period 6/15/98-6/14/03.

Prior to the reporting period covered herein, the following occurred:

- Robert Brower, Director of the RACNE (CCRAC) served on the Steering Committee of the New England Regional Climate Change Impacts Workshop, sponsored by the National Science Foundation and the White House Office of Science and Technology. This workshop was held September 3-5, 1997 at the Institute for the Study of Earth, Oceans, and Space, University of New Hampshire, Durham New Hampshire. He also addressed the conference as a plenary speaker from the local government perspective, chaired the Government and Resource Management breakout group, and authored the findings section of the report for that group.
- Subsequently, he was an invited participant in the U.S. Climate Change Forum, the Consequences of Global Change for the Nation, held November 12-13, 1997 in Washington, D.C.
- The Cayuga County Regional Validation Center was chartered by NASA.

The result of these experiences confirmed the value of the initial RAC focus on water resource impacts from climate change, while noting also the potential for cross cutting applications to other local government application areas such as community growth, emergency management, and agriculture.

Please note that the thirteen objectives of the grant covered by this report are presented and numbered in material that follows below. The bulleted text that follows each numbered objective is presented as summary material that is descriptive of the resulting significant findings or accomplishments as required.

- 1) Build upon others experiences to identify local issues for which Earth systems science data can be applied, including climate variability issues of relevance to the local policy maker and resource manager.
 - Mr. Brower chaired the NYS Local Government Advisory Committee to the NYS GIS Coordinating Body during the reporting period. The group met approximately six times during the reporting period. As a result of RACNE sponsorship, four special

presentations were provided on GIT in state and local programs by representatives from Missouri, Wisconsin, Vermont, and Pennsylvania.

- At NASA's request, RAC Director Robert Brower served on the Steering Committee that conceptualized and planned a series of five remote sensing workshops, held across the United States for state, local, regional, and tribal governmental representatives. Staff actually attended all five workshops and hosted the third for the Northeastern United States on October 26-27 2000. Over 150 officials from 14 states attended the conference in Auburn, New York. The workshops and integrated breakout sessions became the basis for understanding state and local government functional interest areas and related data requirements. Land use and land cover emerged as an initial core data set.
- 2) Scope, design, pilot, and evaluate a two-way information transfer process which integrates a wide range of remotely sensed "core" data, derived from local stakeholder interests and made available from the "The Earth Science Enterprise" project, into local decision making processes, upon demand.
- Progress was made during the life of the grant on the conceptualization of a two-way information transfer process, on defining "core" data and on the understanding of local decision making processes.
 - The RAC program software suite and associated hardware requirements were reviewed, data storage requirements were estimated, including those associated with the New England Regional Climate Variability and Change Assessment. The results were published in "A Technical Report for the Cayuga County Regional Application Center Systems Engineering Analysis," submitted to the Cayuga County Regional Application Center, Cayuga Community College, January 1999, by the New York State Technology Enterprise Corporation (NYSTEC).
 - The Rodin software suite was installed and made operational at the Regional Application Center in July 1999, in Auburn. Exploration of various GIS programs for capturing "ground truth" for correlation was also begun.
- 3) Develop the organizational capacities for a web-based two-way information transfer process (via a Regional Application Center) which has the potential to facilitate the use of locally captured "ground truth" data sets for correlation with other data including remotely sensed imagery.

- A review of organizational requirements was undertaken and the process of organizational capacity building was begun. Staff capacity was advanced with the creation and filling of the first five positions during this grant period, and human resource capacity was enhanced through the collaboration of the New York State Technology Enterprise Corporation (NYSTEC) and Global Science and Technology (GST). Additional capacity was provided by consultants which performed a range of tasks and services. The following positions were created and filled:
 - Director
 - Executive Assistant
 - Operational Manager
 - Remote Sensing Engineer
 - Extension Specialist
 - Systems Engineer (GST)
 - Program Development Specialist (consultant, GeoManagement Associates)
 - Geographic Information Technicians (GST)
 - Graphic design (consultant)
 - Technical writing and information systems (consultant)
 - A two-day "Sounding Board" retreat was held in February 2000 to review the RACNE organizational structure and future plans. An estimated 12-15 representatives from NASA, collaborating entities, and similar institutions came together with external reviewers from throughout the country to advise on and guide the organizational capacity development of the RACNE.
 - The Northeast Affiliates Group was established from the primary GIT Coordinators in each of 14 northeastern States, creating a network of advisors and collaborators. The first meeting was held in July 2000 with nine states represented.
 - The Classroom Cabinet was established, creating a group of educational advisors and to help champion the application of technology and data from ESE into the classroom setting.
 - In March 2001, the Institute for the Application of Geospatial Technology (IAGT) was formally established and became responsible for all NASA-RACNE administrative and programmatic activity.
- 4) Apply the technological capacities for data development, integration, synthesis, and analysis and for a web-based GIS information transfer process (via a Regional Applications Center) which facilitates the distribution and use of

“core” data sets, including climate variability data sets for local coping and mitigation strategies.

- A T-3 line was installed and made operational in November 1999.
- COTS GIS software was purchased and installed.
- COTS web-based GIS local government experience was reviewed; preliminary findings from climate change workshops were reviewed.
- Satellite data experience and use by state and local governmental entities throughout the nation were reviewed.
- The above reviews were summarized and published in “Preliminary Review of Satellite Data Experiences, Potential, and Issues in Local Government, A Report to the Regional Application Center for the Northeast (RACNE) Governing Council,” November 1999, Lisa Warnecke, PhD, MBA, Leslie Wollack, MPA.

5) Test the above approach by initial focus on the hydrologic / hydraulic impacts of climate variability in the Finger Lakes Region...

- Climate Change workshops concluded that greater seasonal variation in precipitation patterns throughout the Finger lakes were anticipated, creating the potential for higher frequency drought and flooding.
- The need for a high accuracy digital terrain model (DTM) was concluded, and preparation began for a LiDAR data collection collaboration with New York State and the County of Cayuga for an entire political subdivision (County of Cayuga) and an entire watershed (Owasco Lake).

6.) Acquire and install data capture hardware, including satellite and associated systems.

- The first satellite ingest system (GOES) was installed in June 1999. Construction plans delayed the second ingest installation until Fall 2003. The second ingest array (MODIS) has been contracted for installation by Global Science and Technology (GST) and will be operational September 17, 2003.
- The initial local area network (LAN) design was completed by the New York State Technology Enterprise Corporation (NYSTEC) and system installation began. The wide area network (WAN) design also began in 1999 under the provisions of this grant.

- A Virtual Private Network (VPN), security firewall, T-3 line and fiber backbone were installed in 2000 by GST, linking the RACNE, local government collaborators and the Cayuga Community College network.
- 7.) Proceed with acquisition of high resolution orthorectified imagery and photographic data sets, assuming lower altitude sources, based on “core data” identified by stakeholders to establish baseline data sets, and begin dissemination dialog with local stakeholders.
- Collaboration with Cayuga County resulted in the availability of orthoimagery for the County
 - Collaboration with New York State resulted in the availability of orthoimagery for New York State. The RACNE became the spatial data repository for one meter pixel image size (smallest field of view) infrared imagery covering the entire state under an agreement with the New York State Department of Environmental Conservation.
- 8.) Acquire low and high resolution multi-spectral imagery and other data sets, assuming inclusion of higher altitude sources, including satellite imagery, and begin dissemination dialog with local stakeholders.
- Review of various satellite imagery products began concurrent with preliminary work on delivery mechanism
 - Image requirements were derived from stakeholder breakout sessions at the Oct. 2000 RS Workshop for the Northeast and networking and dialogue continued with the Northeast Affiliates.
 - Detailed soils data were located for Cayuga County and collaboration with National Resource Soil Conservation Service and the Soil and Water Conservation District resulted in digitizing the soils data.
 - The first eight Landsat 7 scenes were purchased, first NALC triplicates, and first AVHRR images were acquired. GOES images were also acquired subsequent to system installation.
- 9.) Undertake fusion of data sets resulting from objectives 7 and 8 above for validation of satellite imagery and high altitude photogrammetry utilizing baseline data, and begin dissemination dialog with local stakeholders.
- Preliminary work on the development of core watershed data began with a focus on the Owasco Lake Watershed.

- Preliminary work began on the development of a system to assist with the local government response to state regulations addressing environmental impact assessment and review processes
- Preliminary work began on the development of an economic development (facilities siting) system to help market sites available for development

10.) Explore and pilot in cooperation with Code 935 and ESRI, the seamless integration of RAC imagery with commercially available GIS software, to explore the viability of commercial applications and enhance the potential for data distribution to local government throughout the Northeastern United States.

- During the time of this grant, the NASA chartered Regional Validation Centers became Regional Application Centers. Rodin was the name given to a software suite that was developed by NASA.
- Rodin was developed by Code 935 at the Goddard Space Flight Center in concert with Global Science and Technology (GST). It was intended as the primary mechanism for remotely sensed data sharing between 14 Regional Application Centers throughout the United States.
- NASA elected to terminate all Code 935 support for the RAC program, including software development activities, effectively eliminating the program during the time period covered herein. (Ed. note: Subsequently, seven Regional Earth Science Application Centers (RESACs) were established by NASA and funded for 3 years. All funding support from NASA for RESACs expired in 2002. No RESAC proposals were supported under subsequent CANS awarded in 2003. NASA abandoned plans to establish a regionally-based organizational framework through which applications derived from the Earth Science Enterprise (ESE) would be distributed to state local and tribal governments in favor of other approaches. The RACNE is fully engaged in these new approaches.)
- A search began for geospatial COTS software to facilitate the transfer of data through which remote sensing data could be more easily integrated into decision making processes.

- ESRI products were used (non-exclusively) and Rodin software was installed and supported without the involvement of Code 935 as initially anticipated.

11.) Pilot and review the mechanisms for information transfer, including but not limited to distribution of RAC data, classified images, and documents for cross-disciplinary integration into local decision making and into educational curriculum as well as other educational purposes.

- RACNE Director led Classroom Cabinet members to the Conference on Remote Sensing in Education (CORSE 2000) in Mississippi. Subsequently the participants analyzed the conference content, and became the Steering Committee for CORSE 2001, hosted by the RACNE in Auburn.
- CORSE 2001 was planned and developed largely under the provisions of this grant but attendance and other costs were funded from a subsequent grant.
- Web based GIS was the focus of interest for transfer of RAC data and integration into state and local government decision making.
- Work study programs were established and the first 2 students began working with the RACNE.
- The first class of Global Learning and Observing to Benefit the Environment (GLOBE) participants (16 teachers) was trained in April of 2001 at the RACNE through collaboration with Cornell University.
- Extensive outreach to area schools began, including GIS Day activities, local cable broadcasts, and the planning for newsletter publications, monographs, and GIT career camps.
- Numerous training sessions, presentations, and workshops were held by RACNE staff.

12.) Establish and pilot a data acquisition loan pool to generate and sustain a market value financing mechanism, based on product delivery metrics, for use by local government.

- Loan pool/grant guidelines were written and distributed to members of the Northeast Affiliates Group and materials descriptive of the program were also distributed.
- The pool established for such purposes is \$350k.

13.) Formalize and offer initial courses within a curriculum leading to a two year GIS Associate's degree from Cayuga Community College.

- A state of the art GIS Lab was designed and installed at the college in the summer of 2000.
- The curriculum and A.S. degree program was developed and fully accredited by the New York State Department of Education. The first students were enrolled in the fall of 2000.
- Approximately 50 students attend GIT classes each semester and about half of this number are majors in GIS.
- An articulation agreement was established with the State University of New York College of Environmental Science and Forestry, securing full credit for all GIS course work for CCC transfer students.

The image shows two handwritten signatures of Robert N. Brower. The signature on the left is written over a horizontal line, while the one on the right is a second, slightly different version of the same signature.

Robert N. Brower
Principal Investigator
Date: September 12, 2003